

SPECIFICATION

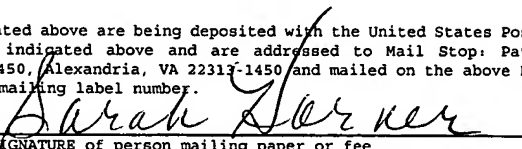
Docket No. 20736.001

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN that I, Jeffrey A. Fagala, a citizen of the United States of America, residing in the State of Texas, have invented new and useful improvements in an

Air Intake System for an Internal Combustion Engine

of which the following is a specification:

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BACKGROUND OF THE INVENTION

1. Cross Reference To Related Applications:

The present application claims priority from provisional application, serial number 60/498,165, filed August 25, 2003, having the same title and by the same inventor.

2. Field of the Invention:

The present invention generally relates to air intake systems for internal combustion engines and more particularly to an air intake apparatus for high performance internal combustion engines having an improved flow of air to maximize induction of air-fuel mixture into the engine.

3. Description of the Prior Art:

The air intake of an internal combustion engine is a critical part of the engine system. The power output of the engine varies in proportion to the volume of air that can be taken in by the engine per unit time. The volume of air that can be taken in by the engine further depends on the *absence* of (1) obstructions to the flow of air; (2) uneven distribution of the air flow; and (3) any factor which would reduce the velocity of the flow of air.

In the prior art, one device disclosed in U. S. Patent No. 2,267,706, issued to Baile et al., teaches a horizontal intake and a relatively long vertically oriented intake runner in a spiral configuration and having a decreasing cross-sectional area. Another prior art device, disclosed in U. S. Patent No. 2,388,213, issued to Mock, teaches a substantially horizontal intake leading through an approximately right angle bend to a relatively short vertical runner and having an "island" baffle disposed in the airflow path within the region of the right angle bend to control the velocity of inducted air.

1 In yet another example, the prior art air scoop 17 shown in Figure 1 for a racing engine
2 assembly 11 encloses the intake port area of a Roots-type supercharger 15. The air scoop 17 is
3 mounted on the air inlet mounting flange 19 of the supercharger 15, which in turn is mounted on an
4 intake manifold portion of the engine block 13 of the engine assembly 11. The inlet portion of the
5 scoop essentially duplicates the cross-sectional area of the intake opening into the supercharger, and
6 couples it with an air chamber to a position facing the direction of travel of the racing vehicle, e.g.,
7 a drag racing vehicle or tractor pull vehicle, in order to collect the air to be inducted into the
8 supercharger and the engine. The flow of air is controlled with a system of butterfly valves 21,
9 typically coupled to the throttle linkage (not shown) of the engine 11. As the vehicle gains speed, the
10 forward motion of the vehicle forces more air into the inlet portion of the air scoop to supply the
11 increased demand for air needed to increase the power of the engine.

12
13 These prior art scoops have the disadvantage of restricting the air flow into the engine because
14 of one or more of the following impairments: (1) the relatively sharp bends in the intake air passages;
15 (2) the lack of directed passages to guide the flow of air into the supercharger air intake; (3) the
16 likelihood of an uneven distribution of air; or (4) the relatively long and circuitous air passages,
17 especially in the higher RPM ranges where an engine's power output and need for air tends to be
18 greatest. What is needed is a less obstructive, more uniform and higher velocity air flow path into
19 the engine, which provides an increased air intake volume. Moreover, an improved air intake system
20 should also be no more complex or costly to manufacture and should preferably be a 'bolt-on'
21 modification requiring minimal additional changes to the engine. An ancillary benefit would result
22 if an improved design also permits utilizing ram effects at speed to increase the intake air volume.

SUMMARY OF THE INVENTION

Accordingly, there is disclosed herein an improved air and fuel intake system for a high performance internal combustion engine for installing on a supercharger or the intake manifold of the engine. The air intake system is attached to the mounting surface of the supercharger or intake manifold such that the air passages of the intake system are in corresponding alignment with of the air inlet openings in the mounting surface or manifold. The air intake system includes a forwardly disposed air inlet, which faces in the direction of travel of a vehicle powered by the engine. One or more air passages lead directly from the air inlet toward and correspond respectively to the one or more air inlet openings in the manifold, wherein each air passage has a decreasing cross-sectional area along the direction of air flow. In another aspect, the air passages are substantially vertical in orientation with a minimum of bends in each passage to direct intake air directly into the air inlet openings of the manifold.

In another aspect of the invention the air intake is controlled by butterfly valves disposed on and operated by a common shaft. In yet another aspect of the invention the air intake is controlled by individual butterfly valves disposed on and operated by separate shafts. The butterfly valve shafts may be actuated by mechanical linkages or solenoid operated linkages or the like.

1 **BRIEF DESCRIPTION OF THE DRAWINGS**

2
3 **Figure 1** illustrates an example of a prior art air scoop installed on a supercharged racing
4 engine;

5
6 **Figure 2** illustrates one embodiment of an air intake system installed on a supercharged racing
7 engine according to the present invention, the air intake system having air control butterfly valves
8 mounted on and operated by a common shaft;

9
10 **Figure 3** illustrates a cutaway view of the air intake body showing the internal air passages
11 of the air intake system according to the present invention;

12
13 **Figure 3A** illustrates a view of the cross-section of the air intake body 25 at section A-A of
14 Figure 3;

15
16 **Figure 3B** illustrates a view toward the air inlet of the air intake body of Figure 3;

17
18 **Figure 4** illustrates an elevated perspective view from the rear of one embodiment of the air
19 intake system according to the present invention with details of the fuel line system shown thereon;
20 and

21
22 **Figure 5** illustrates another embodiment of the air intake system of the present invention
23 having circular air control butterfly valves mounted on and operated by separate shafts coupled to
24 a portion of an actuating linkage.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figure 2, there is illustrated a racing engine 13 equipped with a supercharger 15 and one embodiment of the air intake system 23 of the present invention. In the description that follows, the 'air intake system' of the present invention may also be known as an 'injector' or an 'injector hat.' The air intake system 23 includes an air inlet body portion 25 (also termed an air inlet body 25) mounted to the intake port 27 of the supercharger 15 and one or more butterfly-type air valves 29 installed in an air valve housing 33 of the air intake system 23. In the illustrative embodiment, the butterfly air valves 29 are mounted on and operated by a common air valve shaft 31. Although a butterfly-type air valve is shown in the accompanying drawings, other types of air valve arrangements may be adapted to the present invention. The air valve shaft 31 is supported within the air valve housing 33. As will be described herein below, the air valve shaft 31 may be actuated by a linkage (not shown in Figure 2) coupled to the throttle of the engine 13.

The air intake system 23 shown in Figure 2 in effect tilts or transposes the intake port (not shown) of the supercharger upward and forward approximately 90 degrees so that its full intake port area faces directly into the incoming air flow. In the embodiment shown, the inlet portions of the air intake passages are vertically disposed, one above the other, which mimics the arrangement of the inlet ports of the supercharger, as though they were tilted forward. This arrangement also minimizes the amount and severity of bending of the air passages within the air intake system, which minimizes any impairment to air flow. Further, the air inlet controlled by the butterfly air valves 29 may be enlarged beyond the intake port area of the supercharger to increase the effective cross-sectional area of the intake port of the supercharger. As will be described herein below, this increase in cross-sectional area at the inlet to the air inlet housing is utilized in conjunction with an ever-decreasing cross-sectional area of the air passages within the air intake system of the present invention to achieve a greater velocity of incoming air flow into the supercharger.

The air intake system 23 of the present invention provides a system of several tube-like air intake passages to divide the incoming air into several equal parts for conducting air to a respective

1 portion of the air intake port of the supercharger. The provision of several substantially similar
2 passages enables the uniform distribution of air inducted into the engine. Further, each passage inlet
3 may have a butterfly or other air valve to control the air induction. Moreover, each passage provides
4 an ever-decreasing cross-sectional area to increase the air velocity in the passage of the air into the
5 engine.

6
7 The inlets of the air passages may be preferably arranged vertically, one above the other, as
8 shown in Figure 2. Alternatively, the inlets of the air passages may be arranged in another
9 configuration, as long as (1) the passages each provide substantially equal amounts of air flowing
10 directly into a corresponding portion of the air intake port of the supercharger, (2) the air passages
11 have no sharp bends or other restrictions to air flow, and (3) the air passages have an ever-decreasing
12 cross-sectional area in the direction of the air flow into the supercharger. For example, in some
13 applications requiring a lower overall profile of the engine/supercharger/injector combination, the
14 air passage air inlets may be configured to approximate a more side-by-side relationship in a lower
15 profile without departing from the principles of the present invention. It will be appreciated that, in
16 such lower profile configurations the air passages may be curved somewhat more than in the
17 illustrative embodiment of Figure 2, or may also have some variation in the shape of their cross-
18 section to couple the air inlets to the supercharger ports.

19
20 In some embodiments of the air intake system 23 of the present invention the internal passages
21 of the air inlet body 25 may have a rectangular cross-section as shown in the figures herein. Other
22 embodiments may employ circular or ovoid cross-sections depending on the application. The
23 butterfly air valves 29 may have the same shape as the internal passages or, in some cases may not
24 be the same shape. For example, the butterfly valves 29 may be rectangular and lead through, e.g.,
25 a transition passage into passages having a circular cross-section. Passages inside the body 25 of the
26 air intake system 23, whether rectangular or of another shape, are configured to gradually decrease
27 the cross-sectional area of each passage by approximately ten to fifty percent, in some typical
28 applications, from that of the butterfly air valve 29 in the air inlet to the cross-sectional area at the
29 outlet of the air inlet body 25 that matches the intake port 27 of the supercharger or other manifold

1 structure of the engine. In the illustrative example shown in Figures 2 through 5, the reduction in
2 cross-sectional area is approximately 17 %.

3
4 The amount of decrease in the cross-sectional area of the air passages is determined in large
5 part by three factors: (1) the maximum air intake cross-sectional area that may be permitted by the
6 rules of the competitive sanctioning organization; (2) the size of the air inlet port of the supercharger
7 (or intake manifold of the engine if a supercharger is not used); and (3) the need to keep the
8 individual air passages as short as possible. The decreasing cross-sectional area of the passages
9 forces the inducted air to occupy a smaller volume, thus compressing the air and increasing its'
10 density and velocity. Moreover, as the speed of the racing vehicle increases, more air is forced into
11 the air inlet and compressed as it is forced through the air intake system 23. The body 25 is also
12 configured to minimize the length of the intake passages and to minimize the number and angle of
13 bends in the paths through the passages. These features together enable a greater volume of air to
14 be mixed with proportionately more fuel, which increases the power output of the engine.

15
16 The air intake system of the present invention may be effectively used on supercharged or
17 unsupercharged (normally aspirated) engines, and with engines utilizing fuel injectors or carburetors
18 disposed on the top of the engine. For example, in normally aspirated engine applications, the air
19 intake system of the present invention may be mounted on or coupled to an intake manifold having
20 intake ports leading to the cylinders of the engine through ports in the cylinder heads of the engine.
21 In this discussion, it will be understood that an intake manifold can be any structure that has passages
22 for conveying air or an air/fuel mixture to the intake ports leading to the engine cylinders. An intake
23 manifold may include one or more carburetors or fuel injection ports for metering fuel into the
24 incoming air stream in the correct proportions. In other applications the air intake system of the
25 present invention may be mounted directly on the cylinder heads wherein the air passages of the air
26 intake system couple directly into the intake ports of the cylinder heads of the engine. The present
27 invention may thus be advantageously adapted to a variety of similar applications because of the ease
28 with which the air intake system 23 may be coupled to the intake ports in the cylinder heads of the
29 engine 13.

1 Referring to Figure 3, there is illustrated a cutaway view of one embodiment of the air inlet
2 body 25 having an air valve housing 33, an air inlet 35, air outlet port 37 and internal air passages 39,
3 43 and 47, and a base 57 of the air intake system according to the present invention. It will be
4 appreciated by persons skilled in the art that the configuration of the internal air passages of the air
5 inlet body 25 provides a substantially uniform distribution of air into the entire intake port area of the
6 supercharger or intake manifold to which the air intake body 25 is attached. This is in contrast to the
7 prior art air inlet devices, which tend to force most of the air toward the rear of the intake chamber
8 or otherwise provide an uneven distribution of air flow into the supercharger. The uneven
9 distribution of air in the prior art devices unnecessarily limits the maximum horsepower output of the
10 engine.

11
12 Although the illustrative embodiment includes three internal air passages (39, 43 and 47), the
13 invention is not limited to three. Generally, the choice of the number of air passages is dependent
14 upon the need to control the distribution of air (by dividing the air flow into separate passages, which
15 convey approximately equal volumes of air into the engine) or the particular control functionality
16 desired. For Example, if progressive actuation of the air valve(s) is desired, two or more air passages
17 and associated air valves would be considered wherein one valve opens first or opens at a faster rate
18 than the next valve. The air intake body 25 shown in Figure 3, including the air valve housing 33 and
19 the passage walls 41, 45 and 49, and even the base 57 may be fabricated as a single assembly of metal,
20 plastic or composite materials, for example. Various processes including casting, molding, or built-up
21 fabrication using pieces cut to size and assembled with adhesives or other fasteners or by welding,
22 etc., may be used to fabricate the air inlet body 25. Important features of the construction include
23 the strength, light weight and durability of the materials used and dimensional accuracy, the shape of
24 the passages and airtight seams and joints, as will be readily appreciated by persons skilled in the
25 industrial arts.

26
27 Referring to Figure 3A, there is illustrated a view of the cross-section of the air intake body
28 25 at section 3A-3A of Figure 3. Shown in this figure are the air passages 39, 43 and 47 formed by
29 the passage walls 41, 45 and 49 respectively.

1 Referring to Figure 3B, there is illustrated a view toward the air outlet port 37 provided in
2 the base 57 of the body 25 of the air intake system of the present invention shown in Figure 3.
3 Shown in this figure are the air passages 39, 43 and 47 formed by the passage walls 41, 45 and 49
4 respectively. In the illustrative embodiment, injection nozzles 51 are shown at six locations in the
5 base 57 to introduce fuel into both sides of the air streams exiting each passage of the air outlet port
6 37 (See Figures 3 and 4). The air intake body 25 is secured to the intake mounting surface of the
7 supercharger or intake manifold using screws inserted through holes 53 in the base 57 at the four
8 locations shown. A gasket (not shown) may be used between the base 57 of the air intake body and
9 the intake mounting surface of the supercharger or intake manifold to provide an air tight joint.

10
11 Referring to Figure 4, there is illustrated an elevated perspective view from the rear of one
12 embodiment of the air intake system 23 according to the present invention with details of one
13 configuration of the fuel lines shown thereon. The air intake system 23 includes the air intake body
14 25, air inlet housing 33 having a butterfly shaft arm 55 and a base 57. The butterfly shaft arm 55 is
15 provided for attaching to actuating linkage (not shown) to control the position of the butterfly air
16 valves, which in turn controls the amount of air admitted into the air intake system 23. The base 57
17 includes mounting holes 53 for installing the air intake system 23 on the mounting surface of the
18 supercharger or intake manifold.

19
20 Attached to the air intake body 25 of Figure 4 is a fuel metering valve 61, known in the art
21 as a "barrel valve," and a fuel distribution block 63. The fuel system used in the illustrative example
22 is known in the art as a "constant spray" system. An inlet fuel line 65 provides fuel to the "barrel"
23 metering valve 61, generally from a fuel pump (not shown) driven by the engine. Fuel is metered
24 through a fuel distribution line 67 to the distribution block 63. Fuel is then distributed through
25 individual secondary fuel lines 69 to each injection nozzle 51. There may be one or more injection
26 nozzles, the number and location being determined by the particular application. One typical
27 configuration places one injection nozzle 51 on each side of each air intake passage outlet port. Other
28 applications may require only one injection nozzle 51 for each air intake passage outlet port.

Continuing with Figure 4, a bypass fuel line 71 returns excess fuel to a section of the metering valve 61 called the pump control poppet valve in the event that the butterfly air valves are suddenly closed to an idle position. This is a safety feature to prevent pumping raw fuel into the engine when it is not needed. Control for the fuel metering valve 61 is provided by directly linking the rotation of a spool valve within the barrel valve 61 to the rotation of the butterfly air valve shaft, both of which may be operated by the engine throttle. Both the spool of the barrel valve 61 and the shaft 31 of the butterfly valves 29 may be attached to individual crank arms (such as crank arm 55), which in turn may be coupled together by an adjustable-length link. Although not shown in Figure 4, these crank arms and the link between them may be located just below the air inlet housing 33. When the throttle opens the butterfly air valves by a certain amount, the barrel valve 61 is also opened by a corresponding amount, together admitting both air and fuel in the correct proportion to the engine.

Figure 5 illustrates another embodiment of the air intake system of the present invention having circular butterfly air valves mounted on and operated by separate shafts coupled to a portion of an actuating linkage. The air intake system 73 includes an air inlet body 75 mounted to a base 77 having mounting holes 79 for securing the air intake system 73 to the intake mounting surface of a supercharger or intake manifold. The front portion of the air inlet body 75 includes a butterfly air valve housing 81 equipped with three circular butterfly air valves 83, each mounted on and actuated by individual shafts 85. Each circular butterfly air valve 83 controls air flow into a passage 87 through the air inlet body 75 to the air outlet 99 from below the air intake system.

Continuing with Figure 5, each butterfly valve shaft 85 is connected through a hole in the butterfly valve housing 81 to a butterfly shaft arm 89. Each butterfly shaft arm 89 is coupled to an actuating link 91, which is connected to a first arm of a bell crank 93. The bell crank 93 pivots on a pivot bushing 95. The second arm of bell crank 93 is connected to an end of the throttle linkage 97. In operation, as the throttle linkage 97 is moved to the left in Figure 5, the butterfly air valves 83 are caused to open, admitting more air into the passages 87 of the air intake system 73. Moving the throttle linkage 97 to the right in the figure operates to close the butterfly air valves 83 and admit less air into the passages 87. The coupling of the butterfly shaft arms 89 to the actuating link 91 may

1 be fixed, thus operating all of the butterfly air valves 83 together. Alternatively, an adjustable collar
2 (not shown) may be installed on the actuating link 91 near a selected butterfly shaft arm 89 so as to
3 delay the opening of a selected butterfly air valve 83 by allowing the actuating link 91 to slide through
4 a bore in the end of a selected butterfly shaft arm 89 until it contacts the collar. At the time of
5 contact the selected butterfly air valve 83 will begin to open with further movement of the actuating
6 link 91. The rate of opening of a specified butterfly air valve 83 may be adjusted by varying the
7 length of the butterfly shaft arm 89 corresponding to the specified butterfly. In this way the opening
8 of the butterfly air valves may be adjusted to operate in a progressive fashion to meet the airflow
9 demands of a particular application.

10
11 In order to test the performance of Applicant's air intake system, a 557 cubic inch Arias
12 supercharged engine running on an alcohol fuel was installed on and connected to a commercial
13 dynamometer. This is the type of engine which would typically be used in a competitive two wheel
14 drive, tractor/trailer pull contest. In the first test run, a prior art air injector system with horizontally
15 disposed air inlets (as shown in Figure 1) and no vanes behind the butterfly was utilized. One
16 example of such a prior art air injector is a "Buzzard" injector manufactured by the Enderle Fuel
17 Injection Company of Simi Valley, CA. Using this prior art injector, various engine readings were
18 made by the dynamometer, as shown in Table I, which follows. The air intake system of the present
19 invention was then installed on the same engine. The injector nozzles and main jet nozzles were
20 removed from the prior art injector system and installed on the air intake system of the present
21 invention. In this way, identical injector and main jet nozzles were utilized to give a fair comparison
22 of the two systems. The total cross sectional area of the butterfly openings on each of the systems
23 was also approximately the same so that an equal volume of air was initially presented to each system.
24 Readings of the same parameters at the same data points were then made with the dynamometer on
25 the air intake system of the invention. The results are given in Table II, which follows Table I.

TABLE I

Speed rpm	CPower C_HP	C_TQ lb-ft	BLOWER psi	B-TEMP °F	Oil-P250 PSI	Barom "Hg	C.A.T. °F	RelHum %
5000	1514	1591	29	105	84.5	30.32	61	28.9
5100	1545	1591	29.2	105	84.8	30.32	61	29
5200	1556	1572	29.3	105	85.1	30.32	61	29
5300	1560	1546	29.3	105	85.4	30.32	61	29.1
5400*	1531	1489	29.2	106	85.8	30.31	61	29.2
5500*	1515	1447	29.4	107	86.5	30.3	61	29.3
5600*	1514	1420	29.6	107	87.3	30.31	61	29.3
5700*	1501	1383	29.8	107	87.9	30.3	61	29.3
5800*	1520	1376	30.3	107	88.5	30.3	61	29.3
5900*	1553	1382	30.6	109	89.2	30.3	61	29.3
6000	1575	1379	30.8	109	89.8	30.3	61	29.3
6100	1577	1358	30.9	109	90.8	30.3	61	29.3
6200	1578	1337	31.4	110	91.3	30.3	61	29.3
6300	1590	1325	31.7	110	92.3	30.3	61	29.3
6400	1569	1287	32	111	93	30.3	61	29.3
6500	1552	1254	32.3	113	94.4	30.3	61	29.3
6600	1534	1220	32.4	113	96.1	30.3	61	29.3
6700	1441	1129	32.2	114	98.7	30.29	61	29.3
6800	1362	1052	32.4	115	101.2	30.3	62	29.3
6900	1345	1024	32.7	117	101.1	30.31	62	29.5
7000	1313	985.3	33.1	119	102	30.32	62	29.8
Average data in * band								
5650	1522	1416	29.81	107.16	87.53	30.3	61	29.28

TABLE II

Speed rpm	CPower C_HP	C_TQ lb-ft	BLOWER psi	B-TEMP °F	Oil-P250 PSI	Barom "Hg	C.A.T. °F	RelHum %
5000	1530	1607	31	105	83.1	30.33	66	27.5
5100	1563	1610	31.1	107	82.7	30.34	66	27.5
5200	1591	1607	31.2	107	82.8	30.33	66	27.6
5300	1612	1597	31.3	107	83.1	30.33	66	27.8
5400*	1632	1587	31.5	107	83.6	30.33	66	28
5500*	1654	1580	31.9	107	84.1	30.34	66	28.2
5600*	1669	1565	32.1	108	84.4	30.35	66	28.4
5700*	1684	1552	32.3	109	85.2	30.34	66	28.6
5800*	1680	1522	32.5	110	85.8	30.34	66	28.8
5900*	1688	1503	32.7	110	86.4	30.34	67	29.1
6000	1697	1486	33	110	87	30.34	67	29.4
6100	1711	1473	33.2	110	87.7	30.35	67	29.6
6200	1742	1476	33.5	110	88.9	30.35	67	29.9
6300	1741	1451	33.6	112	90.1	30.35	67	30.2
6400	1735	1424	33.9	113	91.3	30.35	67	30.4
6500	1730	1398	34.2	114	92.4	30.35	67	30.7
6600	1746	1390	34.6	114	93.6	30.35	67	31
6700	1778	1394	35	114	95.2	30.33	68	31.2
6800	1790	1383	35.3	115	97.5	30.33	68	31.6
6900	1772	1349	35.7	116	98.7	30.34	68	31.8
7000	1773	1331	36.2	117	99.8	30.37	68	32.2
Average data in * band								
5650	1667	1551	3216	108.5	84.91	30.33	66.16	28.51

1 An invention has been described having several advantages. As can be seen from Table I,
2 approximately 1313 horsepower was achieved with the prior art air intake system at the maximum
3 test RPM of 7000 RPM. As shown in Table II, using the air intake system of the present invention,
4 1773 horsepower was achieved with the horsepower continuing to climb, at the same 7000 RPM.
5 This represents an increase of 460 horsepower using the air intake system of the invention, as
6 compared with the power output of the same engine equipped with the prior art air intake system.
7 Likewise, Applicant's system achieved 1331 pound-feet (lb-ft) of torque at 7000 RPM (see Table II)
8 as compared to 985.3 pound-feet (lb-ft) of torque at 7000 RPM (see Table I) for the prior art system.
9 The data also shows that the horsepower achieved in the prior art system peaked at about 6300 rpm
10 and then rapidly fell off. The horsepower achieved never fell off in Applicant's trial run, but continued
11 to climb to 7000 RPM, the upper limit of the tests.

12
13 The substantial improvement in power output provided by the present invention is believed
14 to be caused by two mechanisms. First, the design of the air intake passages provides a uniform
15 distribution of air to all parts of the air intake of the supercharger. No part of the air intake is starved
16 for air as in the prior art air intake system. Such restriction of air is shown in the test data of Table
17 I above to substantially limit the power output of the prior art configuration. Second, the ever-
18 decreasing cross-sectional area of the air intake passages of the present invention, as the air travels
19 from the inlet ports to the supercharger air intake port, provides an increased air velocity into the
20 supercharger air intake. Both of these mechanisms, in effect, provide a greatly increased volume of
21 air to be inducted into the supercharger (or, the intake manifold of a naturally aspirated engine), with
22 a proportional increase in horsepower output as shown by the data of Table II above. In a typical
23 tractor/trailer pull event, for example, a contestant might utilize four engines on the pull vehicle. The
24 460 horsepower increase per engine achieved by Applicant's system, when multiplied times four,
25 would represent an 1840 horsepower increase, the practical equivalent of adding another engine
26 without the attendant weight increase of the vehicle.

27
28 While the invention has been shown in only one of its forms, it is not thus limited but is
29 susceptible to various changes and modifications without departing from the spirit thereof. For

1 example, the shape, arrangement and number of air passages may be varied to suit a particular
2 application while still embodying the principles of the present invention enumerated herein above.
3 Similarly, the location and number of fuel nozzles may be varied according to the application and the
4 specific fuel requirements of an individual application. Further, the arrangement of the air inlets, their
5 shape, or the means used to control the induction of air thereinto may also be configured to suit the
6 application without departing from the principles of the present invention. While butterfly valves are
7 coupled to a throttle and used to control the amount of air and fuel used by the engine in the
8 illustrative embodiment described herein above, other throttle mechanisms may be adapted to the air
9 intake system of the present invention.